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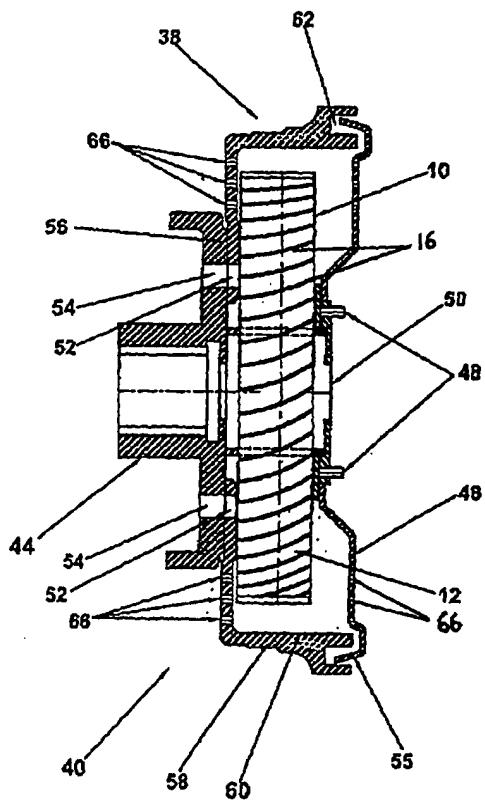
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- (71) Applicant (for all designated States except US): SAFE EFFECT TECHNOLOGIES INTERNATIONAL LIMITED [AU/AU]; HLB Mann Judd, Level 32, 80 Collins Street, MELBOURNE, Victoria 3000 (AU).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): KIERONSKA, Dorota, H. [AU/AU]; Unit 3, 75 Erindale Road, Balcatta, Western Australia 6021 (AU). MORLEY, Vin, C. [AU/AU]; Unit 3, 75 Erindale Road, Balcatta, Western Australia 6021 (AU). NOWAK, Stan [AU/AU]; Unit 11 & 12, 1 Sarich Way, BENTLEY, Western Australia 6102 (AU).
- (74) Agent: MIZZI, Anthony, Paul; Griffith Hack, 256 Ade- laide Terrace, Perth, W.A. 6000 (AU).
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(54) Title: A BRAKE SHOE AND DRUM BRAKE SYSTEM INCORPORATING SAME



WO 02/23060 A1



(57) Abstract: A brake shoe (10) for a drum brake system (40) is provided with a brake lining (12) having a friction surface (14) which faces braking surface (60) of a brake drum (38). The lining (12) is characterised by the provision of one or more grooves (16) extending across the friction surface (14). The shoe (10) may be incorporated in a cooled drum brake system (10) in which cooling is provided by ventilation holes in the drum (38). Cooling may be further enhanced by the provision of ventilation holes (66) in a back plate (46) of the system (40). In an alternate system, cooling is provided by sealing the drum (38) to form a space for holding a volume of oil.



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A BRAKE SHOE AND DRUM BRAKE SYSTEM INCORPORATING SAMEField of the Invention

The present invention relates to a brake shoe and a drum brake system incorporating the  
5 brake shoe, particularly, but not exclusively, for automobiles.

Background of the Invention

A conventional drum brake comprises a drum having an inner circumferential surface that acts as a braking surface and two curved brake shoes each provided with a lining of  
10 friction material that can be selectively forced against the braking surface. The drum is bolted to a rotating axle while the brake shoes are attached to a back plate that is fixed to an axle housing in which the axle is rotatably retained.

Drum brakes have several deficiencies in comparison with disc brakes. One main  
15 deficiency relates to the dissipation of heat. It is known that under high braking conditions drum brakes fade and lose effectiveness because they are unable to dissipate heat at a sufficiently high rate. It is a well known principle that brake components lose their effectiveness when they become saturated with heat. While heat does also build up in a disc brake system, the components of a disc brake system are able to dissipate heat more  
20 quickly because, when the vehicle is moving, the components are in direct contact with a stream of air.

A further disadvantage of drum brakes is the relatively high rate of wear, and unequal  
25 wear rate of the brake lining. This can, at least in part, be attributed to the inherent configuration of the drum brake which encourages dust (from the brake linings), grit and dirt to accumulate in the drum and subsequently become trapped between the brake lining and the braking surface.

Notwithstanding these disadvantages, drum brakes do have a significant advantage over  
30 disc brakes in that they are relatively inexpensive and therefore lead to reduced production costs and vehicle purchase costs. It is for this reason many production cars are manufactured with front disc brakes and rear drum brakes. It is known that between sixty

- 2 -

and ninety percent of a vehicle stopping power comes from the front wheels. Therefore, with the exception of high performance production vehicles, the combination of front disc brakes and rear drum brakes is perfectly adequate.

- 5 It is an object of the present invention to provide a brake shoe and a drum brake system incorporating said brake shoe that attempt to overcome at least one of the above described disadvantages in the prior art.

#### Summary of the Invention

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According to a first aspect of the present invention there is provided a brake shoe for a drum brake system having a drum provided with an inner circumferential braking surface, said brake shoe including at least:

- 15 a brake lining provided with a friction surface for selectively engaging said braking surface, said friction surface having a first and second opposite circumferential edges and first and second opposite axial edges extending between said circumferential edges; said brake lining provided with one or more grooves extending between any two of said edges; and,

20 one or more scraping means supported adjacent said brake lining, each scraping means radially moveable between a first position where said scraping means extends radially beyond said friction surface and a second position where said scraping means is retracted radially to lie substantially flush with said friction surface.

25 Preferably said brake shoe further includes bias means for biasing said scraping means toward said first position.

Preferably a first of said scraping means is located near one end of said brake lining and extends axially across said brake shoe for a width coterminous with said friction surface.

30 Preferably a second of scraping means is located near an opposite end of said brake lining and extends axially across said brake shoe for a width coterminous with said friction surface.

- 3 -

Preferably each of said scraping means is spaced from an adjacent end of said brake lining to provide a corresponding gap therebetween.

- 5 Preferably each of said scraping means is provided with a contact face for contact with said braking surface.

Preferably each of said scraping means is provided with one or more grooves that extends between any two edges of said contact face.

10

Preferably said friction surface has first and second opposite circumferential edges and first and second opposite axial edges extending between said circumferential edges.

15

Preferably said grooves on said friction surface include at least one groove extending between said first and second circumferential edges.

Preferably said grooves on said friction surface include at least one groove extending between said first and second axial edges.

20

Preferably said grooves on said friction surface include at least one groove that extends from one of said axial edges to one of said circumferential edges.

Preferably said scraping means is made of a resilient material having a low coefficient of friction.

25

According to a further aspect of the present invention there is provided a drum brake system including at least:

a brake drum for coupling with a rotatable shaft, said drum having an inner circumferential braking surface; and,

30

a plurality of brake shoes each according to the first aspect of the present invention, said brake shoes adapted for coupling to a stationary plate, and disposed with their respective friction surfaces in facing relationship with said braking surface.

- 4 -

Preferably said drum and brake shoes are juxtaposed so that said scraping means are always in contact with said braking surface.

- 5 Preferably said braking system further includes cooling means for cooling said brake drum and said brake shoes.

In one embodiment, said cooling means includes a plurality of ventilation holes formed in an axial end face of said drum. In this embodiment, said cooling means further includes a 10 plurality of ventilation holes formed in said back plate.

In an alternate embodiment, said cooling means includes a volume of a liquid held within said brake drum, and sealing means for sealing said brake drum.

- 15 Preferably said sealing means includes:

an annular plate having an outer circumferential region and an inner circumferential region, said annular plate coupled about said outer circumferential region to said brake drum, and coupled about said inner circumferential region to a housing in which said shaft is disposed;

20 a fixed seal acting between one of said outer circumferential region and said drum; and, said inner circumferential region and said housing; and,

a dynamic seal acting between the other of said outer circumferential region and said brake drum; and, said inner circumferential region and said axle region.

- 25 Preferably said fixed seal is disposed between said outer circumferential region and said drum, and said dynamic seal is disposed between said inner circumferential and said housing.

According to the present invention there is further provided a wet drum braking system 30 including at least:

a brake drum for coupling to an end of a rotatable shaft, said brake drum having an inner circumferential braking surface;

- 5 -

a plurality of brake shoes adapted for coupling to a stationary plate, each brake shoe having a brake lining provided with a friction surface in facing relationship to said braking surface, each braking surface provided with one or more grooves extending across its friction surface;

5 sealing means coupled between said brake drum and a housing in which said end of said shaft is disposed to form a sealed space enclosing said brake shoes and braking surface; and adapted to hold a volume of liquid.

According to a further aspect of the invention there is provided a drum brake system  
10 including at least:

a brake drum adapted for coupling to a rotatable shaft, said drum having an inner circumferential braking surface; and

15 a plurality of brake shoes adapted for coupling to a stationary plate, each brake shoe having a brake lining provided with a friction surface disposed in facing relationship to said braking surface;

and at least one groove formed on each of said braking surface and said friction surface;

wherein said at least one groove formed on said braking surface extends either between opposite circumferential edges of said braking surface; or, 20 circumferentially along said braking surface; and

said at least one groove formed on said friction surface extends between any two edges of said friction surface.

#### Brief Description of the Drawings

25 Embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is a rear plan view of a brake shoe in accordance with an embodiment of the present invention;

30 Figure 1A is an enlarged view of a portion of the brake shoe depicted in Figure 1 forward of line 1A-1A;

Figure 2 is a front plan view of the brake shoe depicted in Figure 1;

- 6 -

- Figure 3 is a side view in partial section of the brake shoe depicted in Figures 1 and 2;
- Figure 4 is a view through section 4-4 of a scraper incorporated in the brake shoe depicted in Figure 1A;
- 5 Figure 5 is a section view of a brake drum incorporated in a brake system in accordance with an embodiment of the present invention in juxtaposition with a conventional prior art axle;
- Figure 6 is a front view of the brake drum depicted in Figure 5;
- Figure 7 is a section view of a brake drum incorporated in a further embodiment of 10 the present invention;
- Figure 8 is a plan view of the brake drum system depicted in Figure 7 but with a drum cover removed; and,
- Figures 9a-9d depict different groove patterns applicable to the brake shoe depicted in Figures 1-3.

15

#### Detailed Description of Preferred Embodiments

Referring to Figures 1-4, a brake shoe 10 for a drum brake system is provided with a 20 brake lining 12 having a friction surface 14, which in use faces the braking surface of a brake drum, with the lining 12 being characterised by the provision of one or more grooves 16 extending across the friction surface 14.

Conventional drum brake systems are not sealed and therefore are subject to the ingress of water, for example when driving in the rain or through puddles. The grooves 16 assist in channelling any water, brake lining dust and other debris away from the region between 25 the brake drum and the friction surface 14 during braking.

The friction surface 14 has opposite circumferential lateral edges 13 and 15 and opposite axial (leading and trailing) edges 17 and 19 that extend between the circumferential edges 13 and 15. In the embodiment depicted in Figure 2, the grooves 16 extend in a transverse 30 or axial direction across the surface 12 from edge 13 to edge 15. Further, the grooves are provided with a slight curvature. However, as depicted in Figures 9a-9d, the grooves can take many different configurations.

- 7 -

In Figure 9a, the grooves 16 are straight and slope downwardly from edge 13 to edge 15. In Figure 9b, the grooves 16 extend between edges 13 and 15 in the shape of a bow. In Figure 19c, the grooves 16 are in the form of an inflection extending from edge 13 to edge 15. Figure 9d depicts linear grooves 16 extending in the circumferential direction from edge 17 to edge 19 parallel to the edges 13 and 15. Additional inclined grooves 16a (shown in phantom) can also be provided that extend from edges 13 and 15 and are inclined downwardly toward edge 19 converging at a central circumferential groove 16. Further the grooves may follow spiroidal paths between edges 13 and 15.

10

To further assist in cleaning the braking surface of a brake drum prior to a braking action, the shoe 10 is also provided, in this embodiment, with two scrapers 18. One scraper 18 is provided near each end of the lining 12 and extends across the shoe 10 so as to be coterminous with the lining 12. Each scraper 18 is spaced by short distance from its respective end of the liner 12 to provide a small gap 20 between the ends of the lining 12 and the scrapers 18.

The scrapers 18 are, when viewed in the use configuration shown in Figure 3, radially moveable between a first position where the scrapers extend radially beyond the friction surface 14 and a second position where the scrapers 18 are retracted radially to lie substantially flush with the friction surface 14. Ideally, the scrapers 18, and more particularly the shoe 10, is juxtaposed relative to a brake drum so that the scrapers 18 are always in contact braking surface of the drum. In this way, the scrapers 18 continually scrape any dust, dirt or liquid from the braking surface of the drum.

25

Each scraper 18 has a contact face 22 of the same curvature as lining 12 for face to face contact with the braking surface of the drum. The contact face 22 is also provided with one or more grooves 24 extending thereacross. The grooves 24 serve the same purpose as grooves 16 on the lining 12.

30

Mounting blocks 26 are attached to the underside of the shoe 10 opposite the lining 12 for resiliently mounting the scrapers 18. One block 26 is provided on each side of the shoe

- 8 -

mounting rib 28 (which is of conventional shape and configuration being provided with various holes and slots for receiving connecting springs, return springs, hydraulic actuator and the like). Eight spaced apart threaded holes 32 are provided on the underside of scrapers 18 opposite the contact face 22. Each of the threaded holes 32 on scrapers 18 are  
5 adapted to align with corresponding holes 34 provided in each of the mounting blocks 26. Respective screws (not shown) are connected at one end to the holes 32 in scrapers 18 and have a remaining length slidably retained within the holes 34 of the mounting blocks 26. Biased means in the form of two compression springs 36 have opposite ends retained in respective holes of the scrapers 18 and the mounting blocks 26 respectively to bias the  
10 scrapers 18 in the radial direction so as to extend beyond the friction surface 14.

Figure 5 depicts an embodiment of a modified brake drum 38 which together with the  
brake shoes 10 forms a brake drum system 40. The drum 38 is shown in juxtaposition  
with a convention hub 44 and back plate 46. The back plate 46 is fixed to a differential  
15 housing (not shown) by studs 48. A rotatable axle shaft (not shown) is housed in the  
differential housing and extends through central opening 50 in the back plate 46 for  
coupling to the drum 38 and hub 44 in a conventional manner, e.g. by wheel studs (not  
shown) passing through holes 52 and 54 formed in the drum 38 and hub 44 respectively.  
The back plate 52 is formed with a contiguous inwardly turned lip 55, and supports the  
20 brake shoes 10 and other components of the braking system such as the wheel cylinder  
(not shown). The brake drum 38 includes an end plate 56 provided with the holes 52 for  
receiving the wheel studs (not shown), and an axially extending circumferential skirt 58.  
The inside surface of the skirt 58 forms a circumferential braking surface 60 against which  
the brake linings 12 of shoes 10 are pressed during a braking action. The free end of the  
25 skirt 58 is provided with an annular groove 62 for seating, with clearance, the lip 55.

The above described features of the drum 38 and system 40 are common with  
conventional brake drums. The drum 38 however differs from a conventional brake drum  
by the provision of a plurality of through holes 66 formed in the end plate 54. The holes  
30 66 constitute ventilation holes for ventilating the inside of the drum 38 thereby cooling the  
components of the brake system including the shoes 10 and the braking surface 60.  
Cooling can be further enhanced by the provision of further ventilation holes 66 in the

- 9 -

back plate 52. Thus, one form of a drum brake system 40 in accordance with the present invention includes brake shoes 10 as depicted in Figures 1-4 together with a brake drum 38 as depicted in Figure 5. Of course, as should be readily apparent, the shoes 10 can also be incorporated in a standard drum brake system, ie one with a drum 38 and back plate do  
5 not include ventilation holes 66.

Figures 7 and 8 depict a further embodiment of the braking system 70 in accordance with the present invention. The system 70 includes two brake shoes 10 as depicted in Figures 1-4 together with a modified drum 38' and sealing means which includes a sealing cover  
10 72 defining a sealed space 74 for holding a supply of liquid such as oil and in which the shoes 10 and braking surface 60 are disposed. The drum 38' differs from drum 38 by omission of ventilation holes 66. The cover 72 incorporates at its back side back plate 46', which is similar to back plate 52 but without ventilation holes 66. The cover 72 also includes a front casing 73 which is composed of a circumferential band 75 extending in  
15 the axial direction and an annular plate 76 extending radially inwardly from a front end of the band 75. The band 75 is coupled by bracket 77 to the back plate 46', typically by welding. A seal housing 78 is attached to the plate 76 and houses a dynamic seal 79 which forms a fluid seal against an axial flange 80 of a hub 44. A static sealing gasket 81 is provided about a circumferentially arranged studs 48 used for mounting the back plate  
20 46' to the differential housing.

The oil held within the sealed space 74 acts to reduce heat build up by aiding in heat dissipation and also minimises wear of the brake shoe lining 12 and braking surface 60. The cooling effect of the oil may be enhanced by feeding the oil held within the space 74 through an external radiator. This can be achieved by plumbing intake and return conduits through the diff housing into the space 74 for passing the oil through a radiator and returning it to the space 74.  
25

In Figure 8, the braking system 70 is depicted with the drum 38' removed. This shows the  
30 shoes 10 attached to the backing plate 46' and coupled at an upper end to a wheel cylinder 83 and an opposite end by connecting spring 84 and an adjustment mechanism 86. The shoes 10 are operated and move in the same manner as a conventional drum brake system.

- 10 -

However the scrapers 18 act to scrape oil from the braking surface 20 as the drum 38' rotates. This occurs when the friction surface 14 of the shoes 10 are not in contact with the braking surface 60. When the brakes are applied, the friction surfaces 14 are pressed against the braking surface 60. Oil disposed between the braking surface 60 and the  
5 friction surface 14 is channelled away through spiroidal grooves 16, in a manner similar to the way in which the tread of a tyre removes water from a wet road surface.

The provision of the oil within the drum brake system 70 acts to both cool the components of the drum brake system as well as minimise wear of the linings 12.

10

Now that embodiments of the present invention have been described in detail it will be apparent to those skilled in the relevant arts that various modifications and variations may be made without departing from the basic inventive concepts. For example, the system 70 depicted in Figures 7 and 8 depicts the use of two brake shoes 10. However, in an  
15 alternate form, three or more brake shoes can be used in place of the two shoes depicted. This however will require modification to the back plate 46, 46' and the operational mechanism for operating the brake. Further, with reference to Figure 7, in vehicles in which a separate hub 44 is not provided or required, the drum 38 can be sealed at its front end by a circular plate which can be bolted to the drum 38 via the wheel mounting stubs  
20 (not shown) that would pass through stud holes 52 and, a ring-like flange extending integrally and axially from the plate (in a similar manner to flange 80 in the hub 44) or alternately welded or otherwise attached directly onto the drum 38 to act as a sealing surface for the dynamic seal 79. Additionally the braking surface 60 of the drum 38 can be provided with grooves in addition to or instead of the grooves 16 on the braking surface  
25 14. The grooves, if provided on the braking surface, can be formed as extending between opposite circumferential (lateral) edges of the braking surface or circumferentially about the braking surface. Of course there can be a combination of both.

All such modifications and variations are deemed to be within the scope of the present  
30 invention the nature of which is to be determined from the above description, and the appended claims.

- 11 -

**The Claims Defining the Invention are as Follows:**

1. A brake shoe for a drum brake system having a drum provided with an inner circumferential braking surface, said brake shoe including at least:
  - 5 a brake lining provided with a friction surface for selectively engaging said braking surface, said friction surface having a first and second opposite circumferential edges and first and second opposite axial edges extending between said circumferential edges; said brake lining provided with one or more grooves extending between any two of said edges; and,
  - 10 one or more scraping means supported adjacent said brake lining, each scraping means radially moveable between a first position where said scraping means extends radially beyond said friction surface and a second position where said scraping means is retracted radially to lie substantially flush with said friction surface.
- 15 2. A brake shoe according to claim 1 further including bias means for biasing said scraping means toward said first position.
3. A brake shoe according to claim 2 wherein a first of said scraping means is located near one end of said brake lining and extends axially across said brake shoe for a width coterminous with said friction surface.
- 20 4. A brake shoe according to claim 3 wherein a second of scraping means is located near an opposite end of said brake lining and extends axially across said brake shoe for a width coterminous with said friction surface.
- 25 5. A brake shoe according to claim 1 wherein each of said scraping means is spaced from an adjacent end of said brake lining to provide a corresponding gap therebetween.
- 30 6. A brake shoe according to claim 1 wherein each of said scraping means is provided with a contact face for contact with said braking surface.

- 12 -

7. A brake shoe according to claim 6 wherein each of said scraping means is provided with one or more grooves that extends between any two edges of said contact face.
- 5 8. A brake shoe according to claim 1 wherein said friction surface has first and second opposite circumferential edges and first and second opposite axial edges extending between said circumferential edges.
9. A brake shoe according to claim 8 wherein said grooves on said friction 10 surface include at least one groove extending between said first and second circumferential edges.
10. A brake shoe according to claim 8 wherein said grooves on said friction surface include at least one groove extending between said first and second axial edges.
- 15 11. A brake shoe according to claim 8 wherein said grooves on said friction surface include at least one groove that extends from one of said axial edges to one of said circumferential edges.
- 20 12. A brake shoe according to claim 1 wherein said scraping means is made of a resilient material having a low coefficient of friction.
13. A drum brake system including at least:
  - a brake drum for coupling with a rotatable shaft, said drum having an inner 25 circumferential braking surface; and,
  - a plurality of brake shoes each according to claim 1, said brake shoes adapted for coupling to a stationary plate, and disposed with their respective friction surfaces in facing relationship with said braking surface.
- 30 14. A drum brake system according to claim 13 wherein said drum and brake shoes are juxtaposed so that said scraping means are always in contact with said braking surface.

- 13 -

15. A drum brake system according to claim 13 further including cooling means for cooling said brake drum and said brake shoes.
- 5 16. A drum brake system according to claim 15 wherein said cooling means includes a plurality of ventilation holes formed in an axial end face of said drum.
17. A drum brake system according to claim 16 wherein said cooling means further includes a plurality of ventilation holes formed in said back plate.
- 10 18. A drum brake system according to claim 15 wherein said cooling means includes a volume of a liquid, and sealing means for defining a sealed space containing said volume of liquid, said braking surface and said brake shoes.
- 15 19. A drum brake system according to claim 18 wherein said sealing means includes:
  - a sealing cover which extends from behind, to in front, of said drum;
  - a fixed seal provided between a back side of said cover and a housing in which said shaft is dispensed;
  - 20 a dynamic seal provided between a front side of said cover and a circumferential flange extending axially from and coupled to said drum.
20. A drum brake system according to claim 19 further including a radiator located outside of, and in fluid communication with, said sealed space through which said liquid can flow for cooling said liquid.
- 25 21. A wet drum braking system including at least:
  - a brake drum for coupling to an end of a rotatable shaft, said brake drum having an inner circumferential braking surface;
  - 30 a plurality of brake shoes adapted for coupling to a stationary plate, each brake shoe having a brake lining provided with a friction surface in facing relationship to said braking surface, each braking surface provided with one or more grooves extending

- 14 -

across its friction surface;

sealing means coupled between said brake drum and a housing in which said end of said shaft is disposed to form a sealed space enclosing said brake shoes and braking surface and adapted to hold a volume of liquid.

5

22. A drum brake system including at least:

a brake drum adapted for coupling to a rotatable shaft, said drum having an inner circumferential braking surface; and

10 brake shoe having a brake lining provided with a friction surface disposed in facing relationship to said braking surface;

and at least one groove formed on each of said braking surface and said friction surface;

15 wherein said at least one groove formed on said braking surface extends either between opposite circumferential edges of said braking surface; or, circumferentially along said braking surface; and

said at least one groove formed on said friction surface extends between any two edges of said friction surface.

20

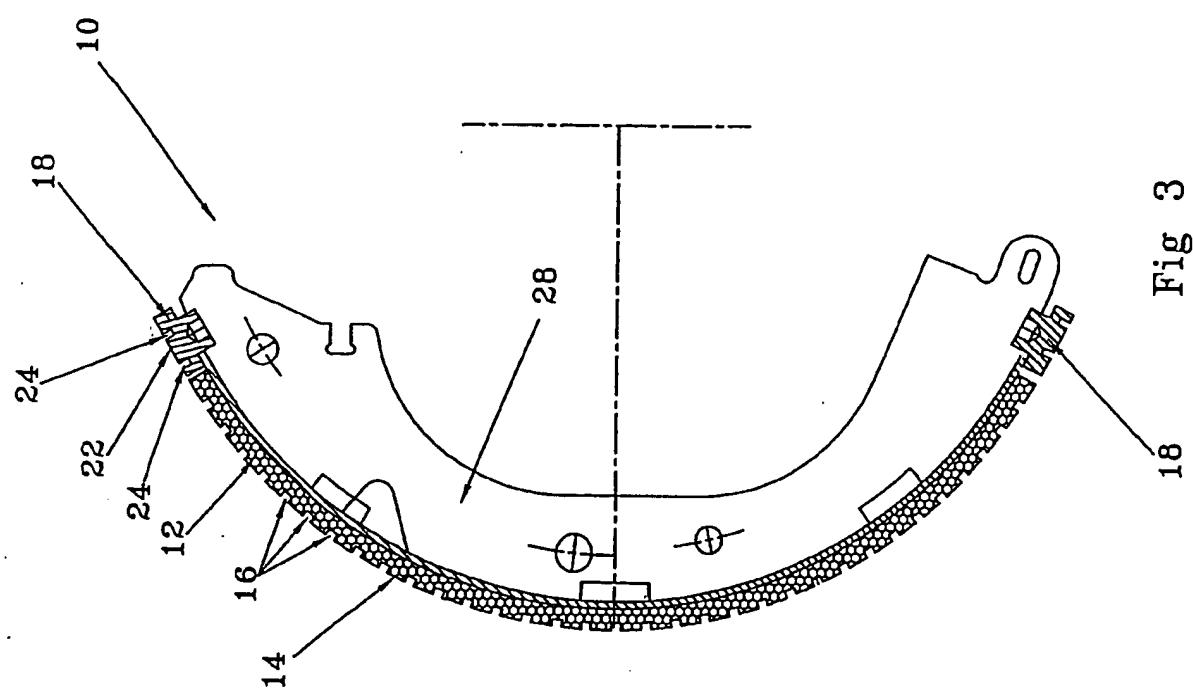


Fig. 3

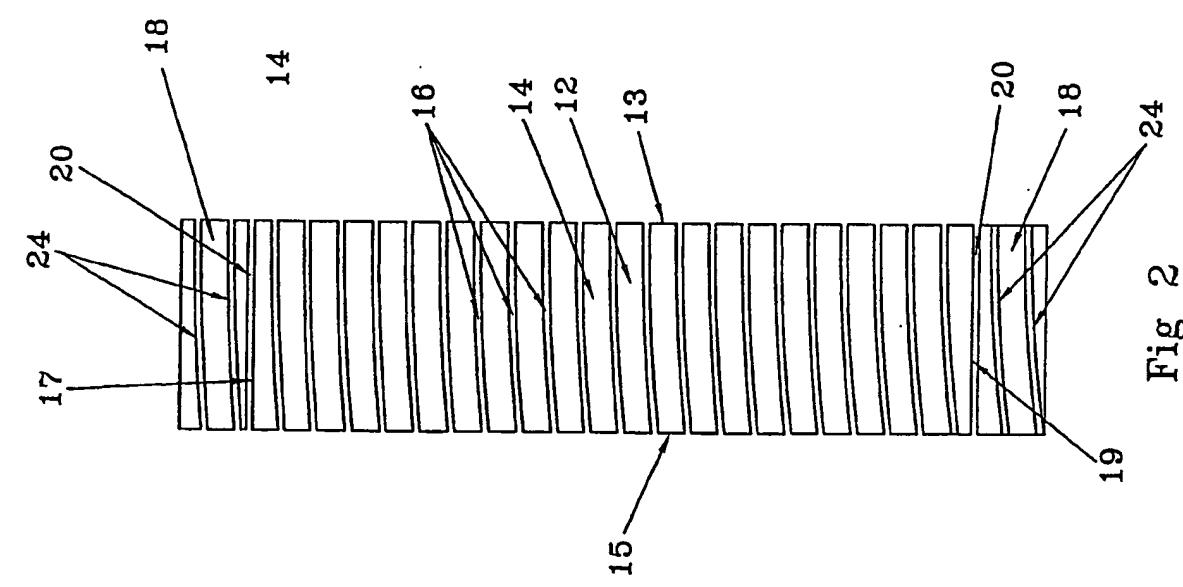


Fig. 2

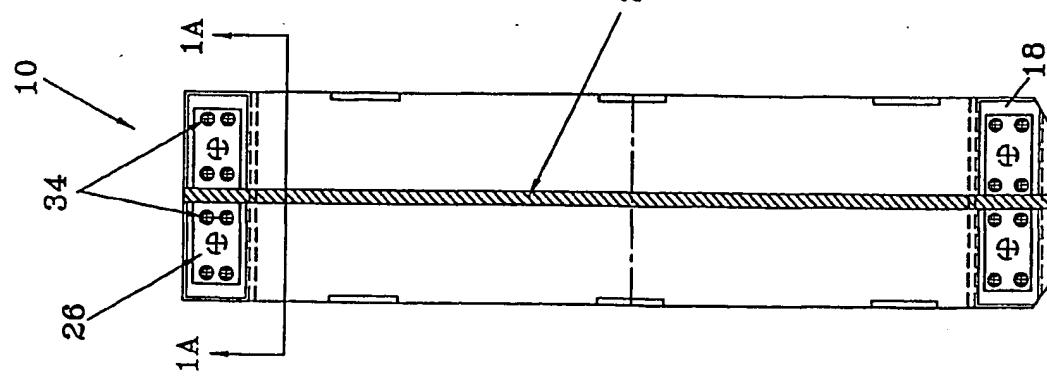


Fig. 1

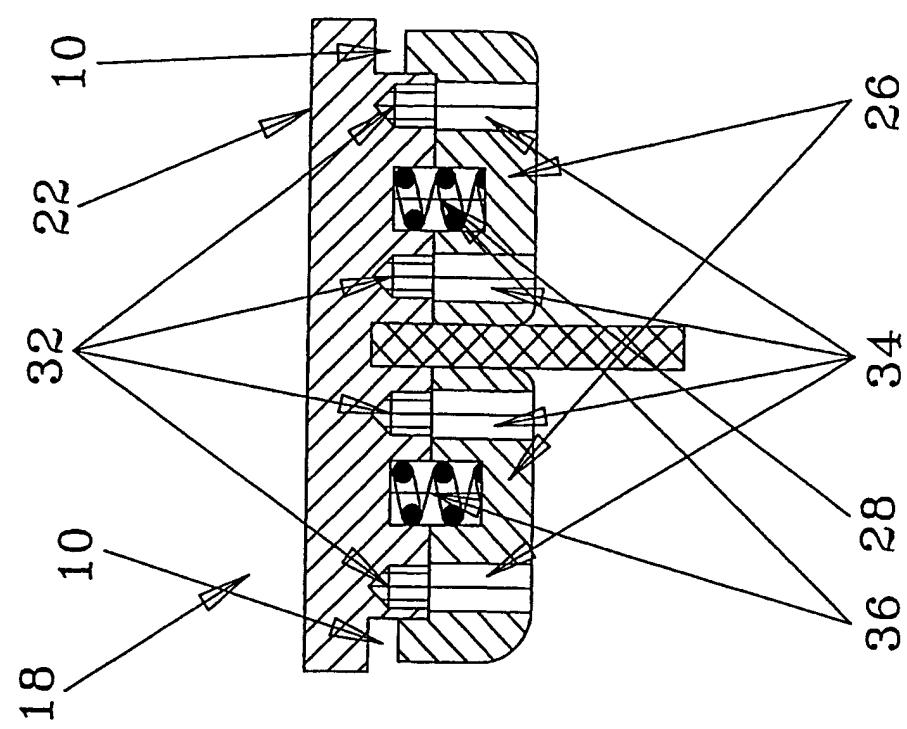


FIG 4

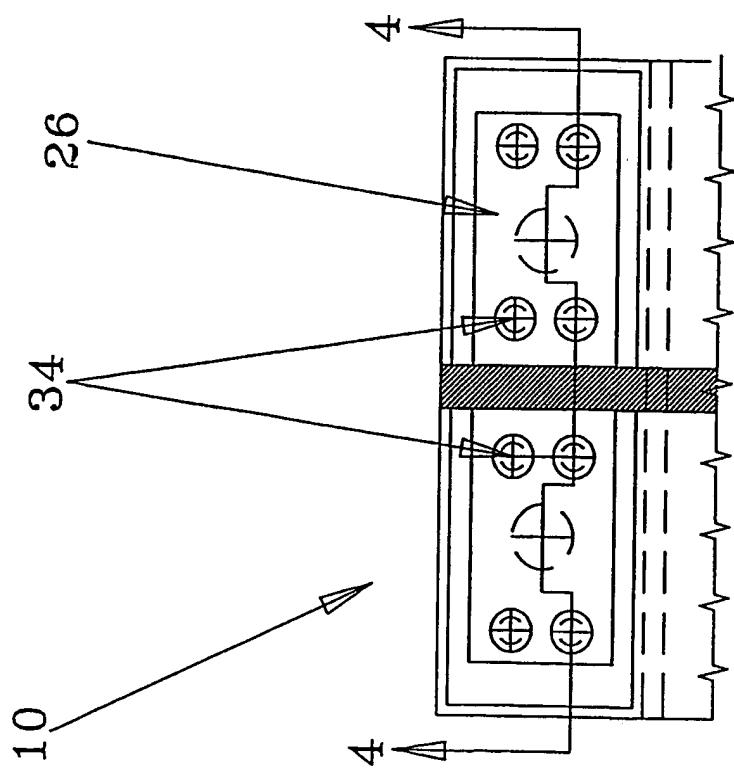


FIG 1A

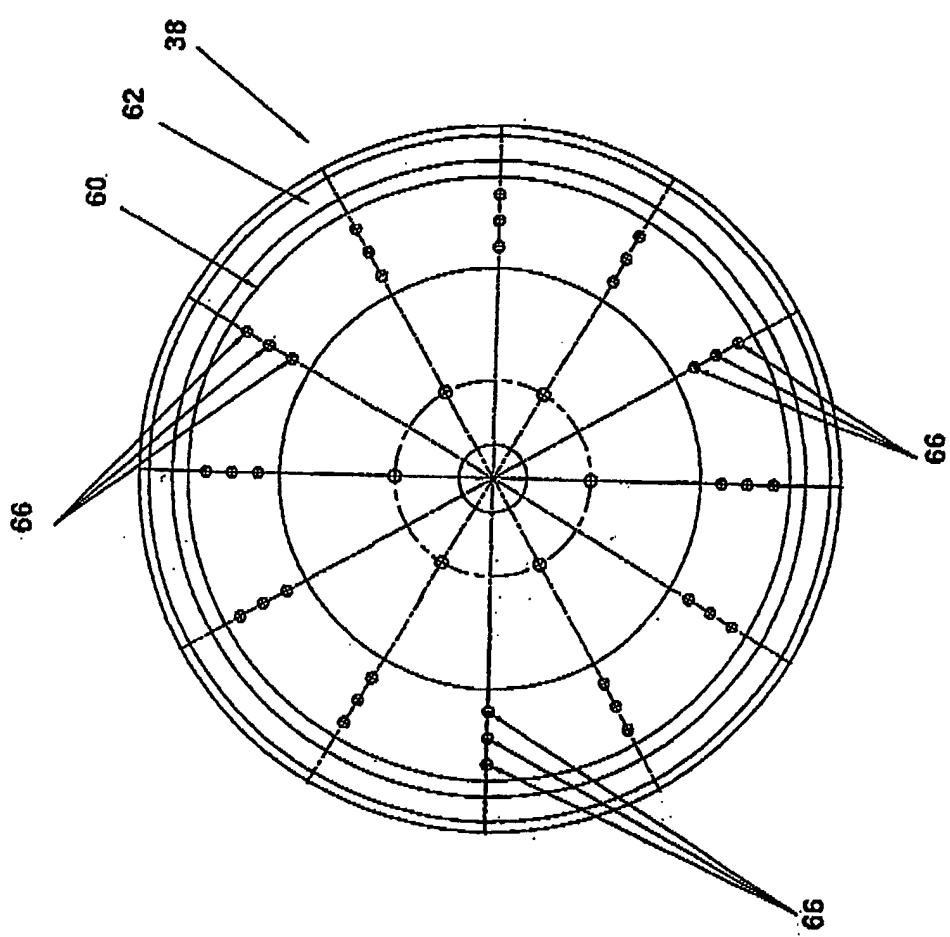


FIG 6

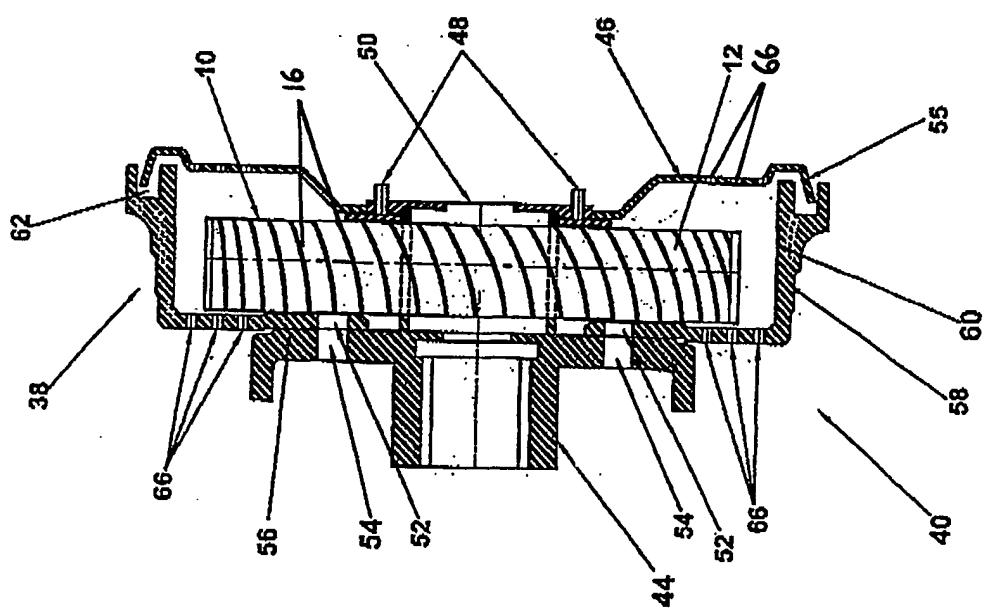


FIG 5

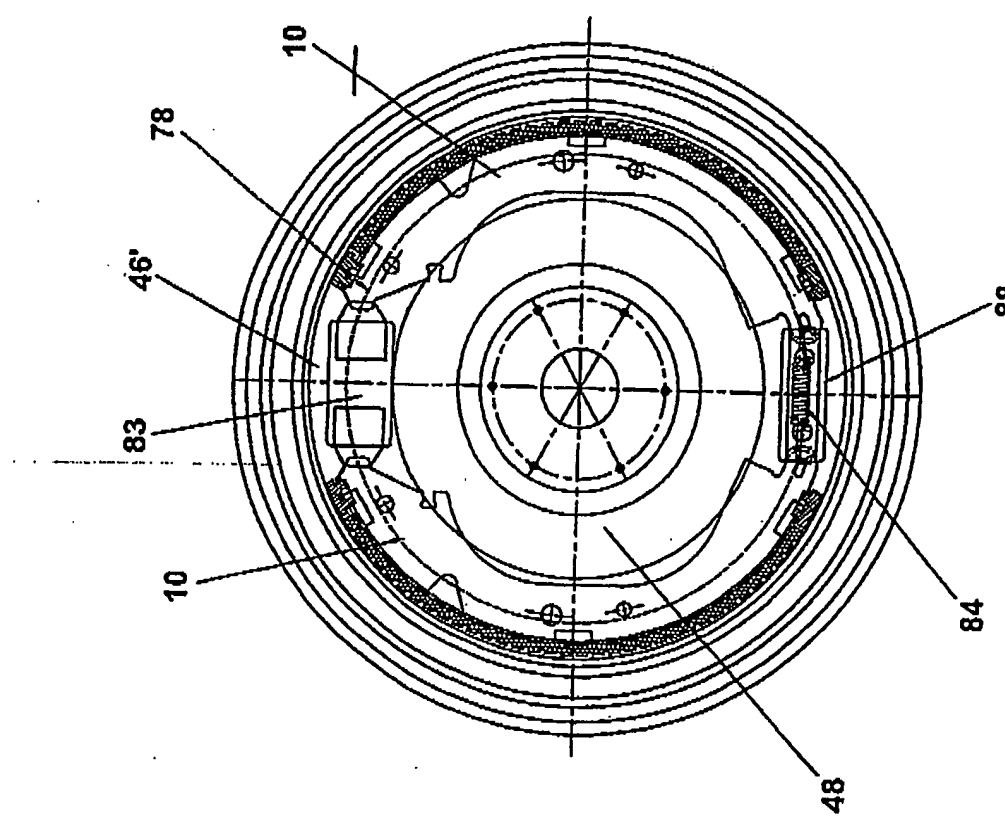


FIG 8

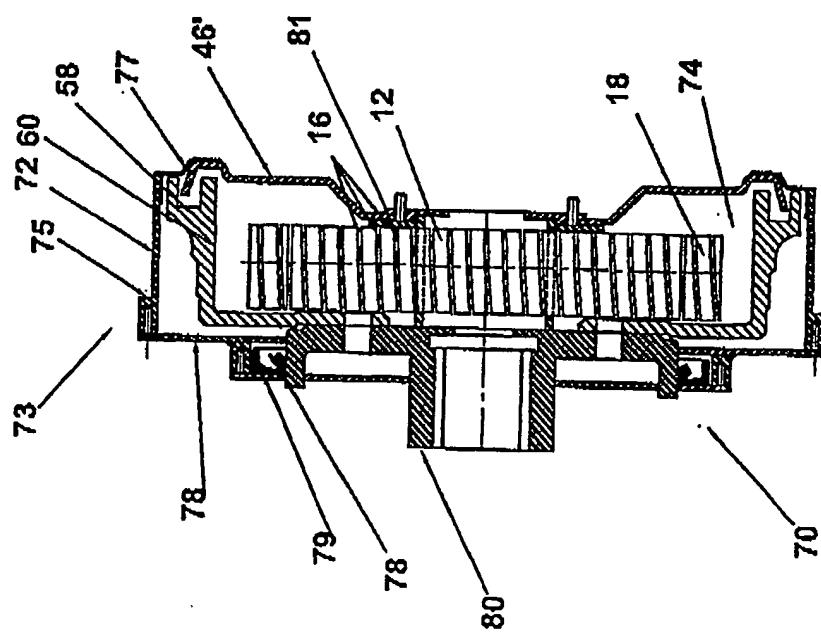


FIG 7

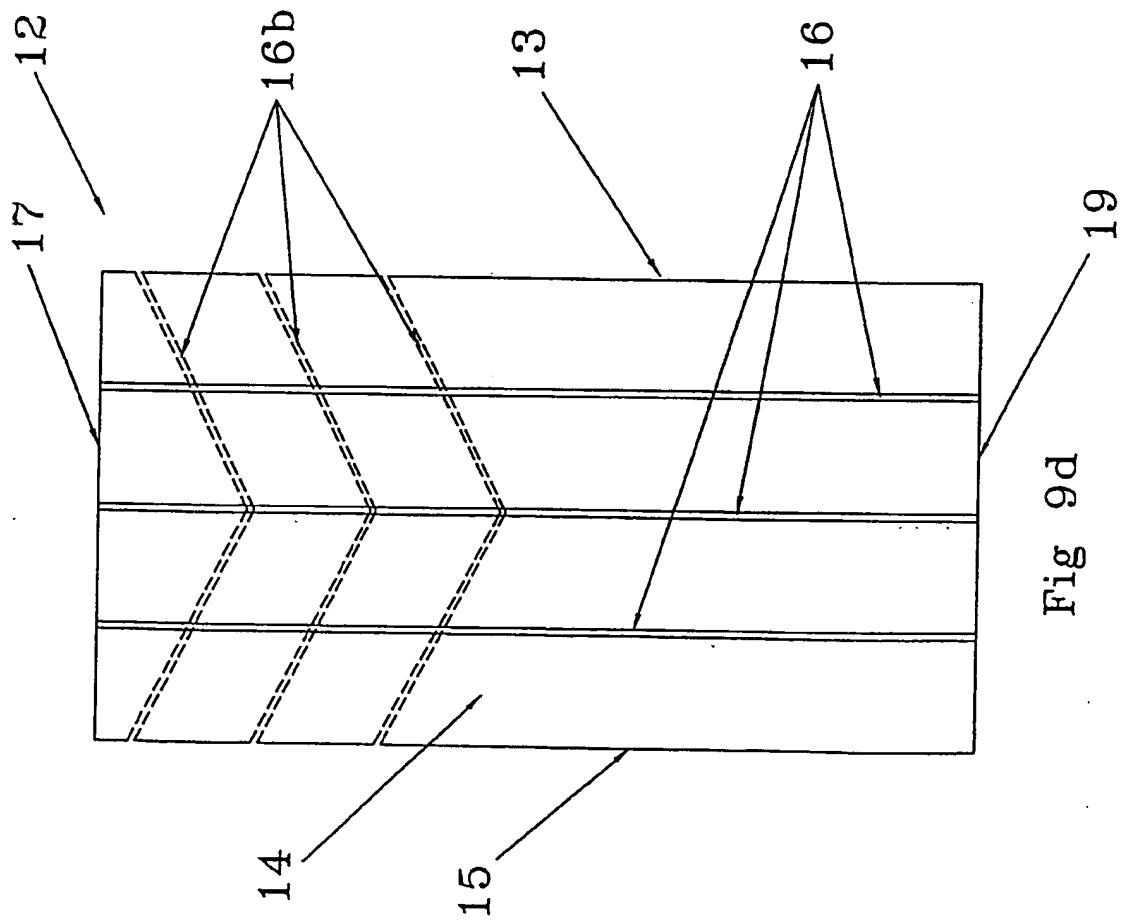
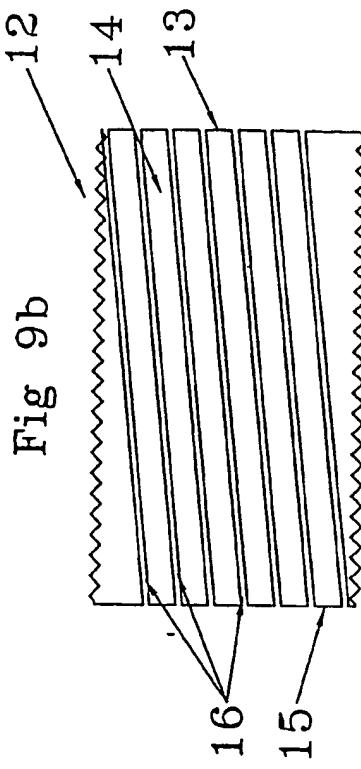
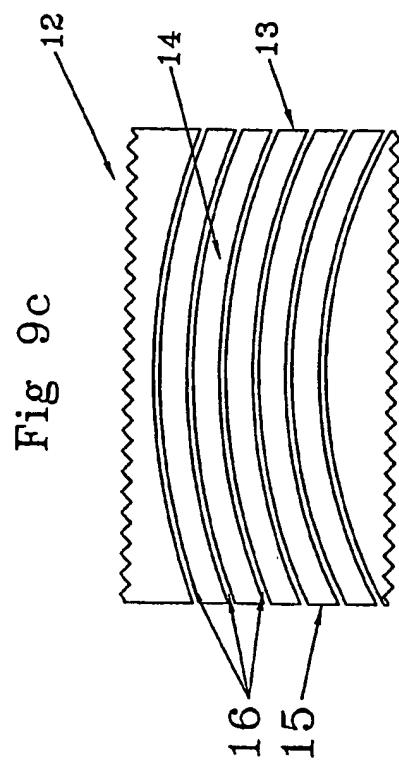
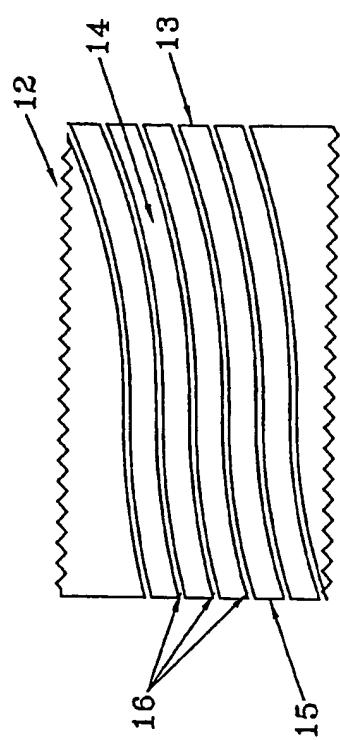


Fig 9d

Fig 9c

Fig 9b

Fig 9a

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU01/01174

**A. CLASSIFICATION OF SUBJECT MATTER**Int. Cl. <sup>7</sup>: F16D 65/08, 65/833, 51/24, 69/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

AU : F16D 65/82

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

USPTO: US CLASSES 188/261, 188/264

DWPI: IPC: F16D AND KEYWORDS DRUM, BRAKE, CLUTCH, SCRAPE, WIPE, CLEAN,CLEAR

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 1124004 A (BARALE) 14 AUGUST 1968 WHOLE DOCUMENT	22
X	US 2875859 A (STREBINGER) 3 MARCH 1959 WHOLE DOCUMENT	22
A	DE 19751914 A (ITT MFG. ENTERPRISES INC.) 27 MAY 1999 WHOLE DOCUMENT	1-20

Further documents are listed in the continuation of Box C     See patent family annex

* Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)		document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed	"&"	

Date of the actual completion of the international search

10 October 2001

Date of mailing of the international search report

16 OCT 2001

Name and mailing address of the ISA/AU

AUSTRALIAN PATENT OFFICE  
PO BOX 200, WODEN ACT 2606, AUSTRALIA  
E-mail address: pct@ipaaustralia.gov.au  
Facsimile No. (02) 6285 3929

Authorized officer

KURT TOBLER

Telephone No : (02) 6283 2469

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/AU01/01174

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2173267 A (DON INTERNATIONAL LIMITED) 8 OCTOBER 1986 WHOLE DOCUMENT	1-20
A	DE 2539557 A (MESSERSCHMITT-BOLKOW-BLOHM GMBH) 10 MARCH 1977 WHOLE DOCUMENT	1-20
A	US 5564533 A (PARSONS) 15 OCTOBER 1996 WHOLE DOCUMENT	21
A	DERWENT ABSTRACT ACCESSION NO.87-028207/04, CLASS Q63, SU 1234-689A (IVANO-FRANK OIL RES) 30 MAY 1986 ABSTRACT	21

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/AU01/01174

**Box I****Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos :  
because they relate to subject matter not required to be searched by this Authority, namely:
  
  
  
2.  Claims Nos :  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
  
  
3.  Claims Nos :  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

**Box II****Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

The international application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept. In coming to this conclusion the International Searching Authority has found that there are different inventions as follows:

See attached sheet

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2.  As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
  
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU01/01174

**Supplemental Box**

(To be used when the space in any of Boxes I to VIII is not sufficient)

**Continuation of Box No: II. Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

1. Claims 1-20 are directed to a brake shoe having one or more scraping means supported adjacent a brake lining. It is considered that the scraping means comprises a first "special technical feature".
2. Claim 21 is directed to a wet drum braking system having sealing means adapted to hold a volume of liquid. . It is considered that the sealing means comprises a second "special technical feature".
3. Claim 22 is directed to a drum brake system wherein at least one groove is formed on each of the braking surface of the drum and the friction surface of the brake shoe. . It is considered that the at least one groove formed on each of the braking surface of the drum and the friction surface of the brake shoe comprises a third "special technical feature".

Since the abovementioned groups of claims do not share any of the technical features identified, a "technical relationship" between the inventions, as defined in PCT rule 13.2 does not exist. Accordingly the international application does not relate to one invention or to a single inventive concept, a priori.

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
**PCT/AU01/01174**

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report			Patent Family Member					
DE	19751914	NONE						
GB	2173267	EP	200316					
DE	2539557	NONE						
US	5564533	AU	27511/92	BR	9206618	EP	607248	
		HK	1014382	NZ	244701	OA	9934	
		WO	9307402	ZA	9207798			
SU	1234689	NONE						
END OF ANNEX								